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INTELLECTUAL SCIENTOMETRICS

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ИНТЕЛЛЕКТУАЛЬНАЯ НАУКОМЕТРИЯ

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ІНТЕЛЛЕКТУАЛЬНА НАУКОМЕТРІЯ

The paper is dedicated to the problems of modern scientometrics that is based on the scientific work information properties, which do not allow adequately assessing fundamentally intellectual properties of knowledge. We offer to solve it by the universalization of scientometrics and its transfer into the system of intellectual indicators, in which concepts are the units of knowledge measurement. Since the metaconcept of intelligence is not defined in modern science, the so-called universal theory is applied to this purpose, which for the first time deduces it from the highest properties of our universe. For the first time the universal metaclassification of knowledge is deduced in accordance with the requirements of the Supreme Certifying Commission. The methods of intellectual scientometrics implementation in science, engineering and education are offered.

Keywords: information scientometrics, intellectual scientometrics, universal theory, universal model, the system of universal concepts, the universalization of knowledge.

Работа посвящена проблематике современной наукометрии, основанной на информационных свойствах научной деятельности, не позволяющих адекватно оценивать принципиально интеллектуальные свойства знаний. Предлагается решение посредством универсализации наукометрии и ее перевода на систему интеллектуальных показателей, в которых единицами измерения знаний выступают понятия. Автор предлагает так называемую универсальную теорию. Впервые выведена универсальная метаклассификация знаний в соответствии с требованиями Высшей аттестационной комиссии (ВАК). Предложены способы реализации интеллектуальной наукометрии в науке, инженерии и образовании.

Ключевые слова: информационная наукометрия, интеллектуальная наукометрия, универсальная теория, универсальная модель, система универсальных понятий, универсализация знаний.

Робота присвячена проблематиці сучасної наукометрії, заснованої на інформаційних властивостях наукової діяльності, що не дозволяють адекватно оцінювати принципово інтелектуальні якості знань. Пропонується її вирішувати за допомогою універсалізації наукометрії і її перекладу на систему інтелектуальних показників, в яких одиницями вимірювання знань виступають поняття. Оскільки метапоняття інтелекту не визначене в сучасній науці, для цього застосовується так звана універсальна теорія, вперше виводить його з вищих властивостей нашого всесвіту. Вперше виведена універсальна метакласифікація знань відповідно до вимог ВАК. Запропоновано способи реалізації інтелектуальної наукометрії в науці, інженерії та освіті.

Ключові слова: інформаційна наукометрия, інтелектуальна наукометрия, універсальна теорія, універсальна модель, система універсальних понять, універсалізація знань.

Introduction. Problems of information scientometrics

Rapidly developing science becomes a leading factor of progress and an immediate productive force of modern society and in this connection it requires an adequate definition and measurement.

Scientometrics was first introduced in the pioneering works of V. V. Nalimov, Z. M. Mulchenko, Y. V. Granovsky and others, as a branch of science based on the idea of science as information process and studying its development through multiple measurements and statistical processing of scientific information [1-3]. It should be mentioned, that the concept of scientometrics is still ambiguous to a considerable degree and requires many specifications since it causes a lot of different poorly explored situations concerning diverse individual and collective subjects for acquiring and using knowledge [4].

Information scientometrics has gained a worldwide recognition and formed a wide field with numerous informational organizations, publications, ratings, publication indexes et al., the improvement of which is successively becoming the absolute estimate and the main aim of every scientific activity at least because the alternative universally recognized ways of knowledge management are missing [5]. However, the more the field develops, the more disadvantages and critical evaluations of information scientometrics appears down to the statement that it becomes an obstacle rather than stimulus for the growth of science [6]. Like every special dogmatic branch of knowledge, as the scientometrics develops, it inverts the inner aims against their natural motion [7]. The reason of this problem lies in the fundamental difference between intellectual nature of science and its information indicators only indirectly reflecting the scientific essence. Informational measurement of deeply intellectual qualitatively different values such as science, knowledge, mind, intelligence, thought, cognition, evidence, study, learning, etc., does not correspond with the content of these concepts and leads to inaccurate and false results. The reason of this problem is the general insufficiency of modern science for scientific formalization of the system of intellectual concepts that is widely recognized by the scientific community and it is the key scientific problem [7]. The reason of a higher order is insufficient level of generalization and abstraction of modern knowledge that can be illustrated by the history of science development given in the table 1.

Table 1 – Classification of the main stages of development of science according to the degree of abstraction and formalization of phenomena

No.	Stage	Content
1	Empirical	Accumulation of experimental knowledge
2	Mythological	Primary formalization of knowledge
3	Antique	Categorization of knowledge
4	Dogmatic	Axiomatization of knowledge
5	Universal	Universalization of knowledge
6	Absolute	Absolutization of knowledge

The first was empirics generalized in the beginning with the myths and legends, and then – with classical antique logical concepts (category, induction, and deduction) up to the reaching of some intermediate concept axioms, forming rather inherently consistent subsystem of derived concepts which are poorly associated with each other (fig. 1a). Such subsystems of concepts can highly describe simple phenomena fitting in one of them, but it poorly describes complex phenomena belonging to several subsystems. Meanwhile the highest connecting universe concepts, bringing all the subsystems together, are ignored.

Intelligence is a complex phenomenon coming from the highest concepts of our universe. Accordingly, it can not be formalized without any universal formalism of the universe as a comprehensive whole. Hypothetically, such formalism, as well as specialized formalisms, is expected to arise from some initial universe concept (the universe axiom, dogma), unifying the whole universe (fig. 1b).

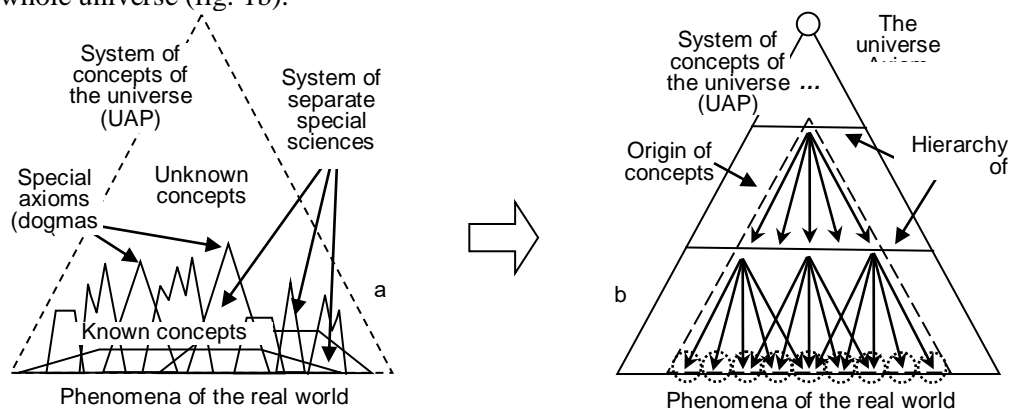


Figure 1 – Scheme of transition from dogmatization (a) to universalization (b) of science

The transition from the system of specialized dogmatic concepts to the single universal formalism is the universalization of knowledge. Apparently, that universalization radically changes the whole system of knowledge and general scientific methodology, and discovers new ways of solution of chronic unsolvable problems of modern science [8]. Moreover, it is shown, that every dogmatic system of knowledge naturally raises unsolvable within its frames problems of this knowledge [9], that can be also naturally solved through the universalization of knowledge by means of transition to the system of universal concepts [10], [11]. Such universalization is successfully implemented in numerous complex problem areas of knowledge, in particular, in the system of intellectual concepts [12], [13]. It allows us for the first time to reveal the most general properties and to create the universal theory of intelligence [14], [15].

The purpose of this paper is to implement a relevant part of this theory in the universalization of the concept of scientometrics and to research the ways of its application to modern science.

Universal system of intellectual concepts

Achieving a universal formalism is an open problem within the frames of modern science. Notably, such formalism can not be derived from the present state of science, as the generalization is realized through the standard procedure of induction, which rapidly loses its accuracy as the level of abstracting rises, and it comes to a standstill at the lowest levels not attaining the highest levels and initial universe concepts on principle. For this purpose the absolutely different methods, missing in modern science, should be applied, that explains the present lack of universal formalism despite numerous scientific and other efforts [10].

In the papers [7], [8], [10], [11], [13], [15] we managed for the first time:

1) to substantiate the possibility and methodology of achieving the universal formalism (universal theory) and

2) to develop the common conception of the universal formalism (universal model), which can both have own significance as a new scientific paradigm [8], and be applied to solve special problems, in particular to formalize the intelligence [7], [8], [11], [13-15].

The universal model, by definition, should be applied to all universe phenomena, that can be achieved through the homotropic description of all the phenomena within the concepts of entity-relation and can be described with the help of modified ER-diagrams, where the vertexes represent entities, and the arcs represent relations, which are understood as (in common case distorted) copies (reflections) of one entities (objects) in other entities (subjects) (fig. 2).

Entities are some parts of the universe singled out by some relations as a unit. Various classifications of types of relations (fig. 3) under various structures of relations produce the diversity of the universe.

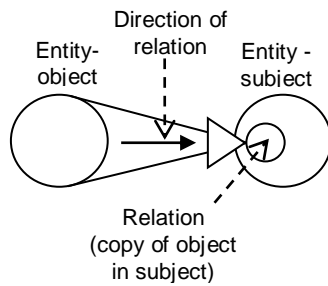


Figure 2 – Scheme of entity and relation

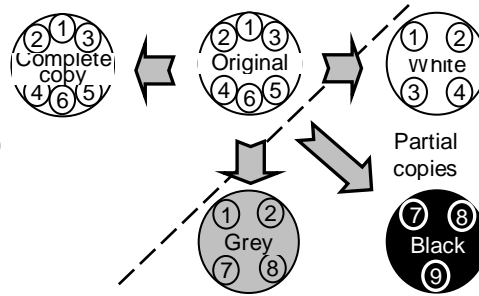


Figure 3 – Classification of types of relations

According to the universal conceptions, cognition of a certain object by some subject is realized through the scheme of movement of a copy of object to a subject in 4 stages (fig. 4): 1) information (condition of a copy at the boundary of the subject), 2) knowledge (condition of a copy inside the subject), 3) understanding (internal harmonization of a copy with other subject's knowledge) and 4) research (external harmonization of a copy with the object – additional purposeful copying). It should be noticed, that information is just one initial stage of cognition followed by other three stages relating to intelligence and discovering fundamentally additional opportunities of cognition as compared with the information ones.

The stated elementary scheme develops for unlimited number of objects (fig. 5) and further for other opportunities. Next in significance problem is the development of this scheme considering the duality of the universe: the abstract and real world (fig. 1b), which are present in every phenomenon. Entities of the abstract world (abstracts, ideas, concepts, categories) are invisible and mutually integrated in the form of the universe abstract «pyramid» (UAP) from the hypothetical initial universe axiom to visible for us entities (phenomena) of the real (material) world in which we exist.

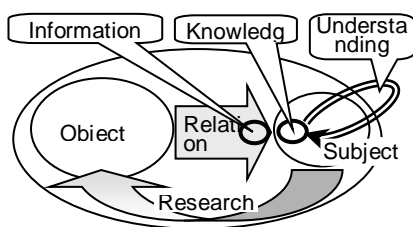


Figure 4 – Scheme of cognition through the research

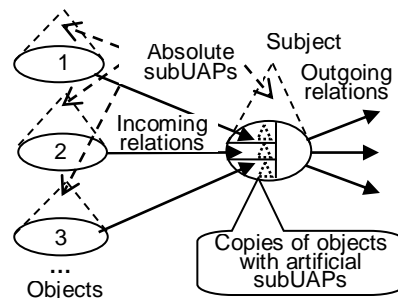


Figure 5 – Scheme of multiple relations of subject

The real world is in itself poorly structured, while the abstract world is highly structured and defines the properties of the universe and its phenomena, the idea of which in material form of phenomena-subjects (abstract virtualization) makes the essence of any cognition. Thus, knowledge is a material copy of the abstract part of phenomena inside the cognizing subject, which, by definition, can represent every universe phenomenon from the lowest to the highest classes. It is mostly fair for living (intelligent) phenomena especially for human as individual subject and mankind as a collective one. Knowledge of the last one is called the science. Abstract concepts are the tools to control the universe, while their subjective analogues are the tools to control the subjects.

Cognition is classified by the types of relations (fig. 3) and it is usually realized with reducing distortions. Consequently, the subjective concepts in general case differ both from universe (absolute) concepts and among cognizing subjects (fig. 6). Any deviation of a copy from the original provokes a respective problem of both cognition and application of concepts by the subjects. Therefore, such deviations should be minimized and subjective concepts should be approximated to the absolute ones, it is called the absolutization of cognition, which is actually the main aim of any cognition.

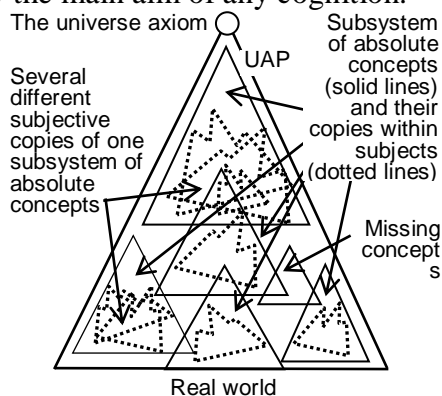


Figure 6 – Classification of basic distortions of cognition

Universal classification of knowledge

Any known universe (absolute) concept discovers a new subsystem of derivative concepts of subject and provokes an increase of active harmonization of subject (passionarity effect), which is approved under condition of due regard for all known concepts (fig. 7).

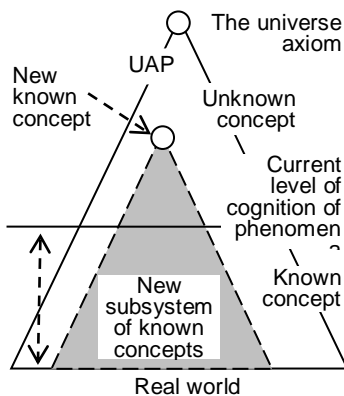


Figure 7 – Scheme of passionarity of subject

Absolute concepts have the following principal relations with subjects: 1) unknown, 2) known and 3) applicable. Unknown absolute concepts degrade the subject, known ones make its development possible, and applicable ones realize this opportunity. These relations fully satisfy the known requirements of the Supreme Certifying Commission (fig. 8):

- 1) discovery of a new concept creating sufficiently large subsystem of concepts (new scientific area), corresponding to the Doctor degree;
- 2) deduction of a known concept through other means (solution of a known problem by more effective method), corresponding to the PhD degree;
- 3) application of a known concept is engineering.

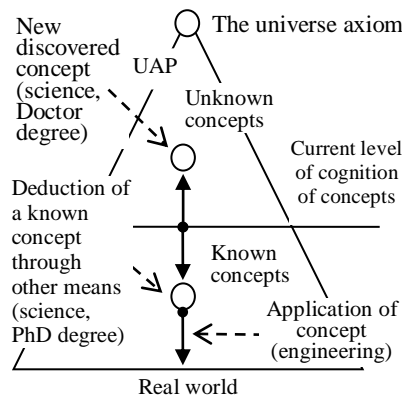


Figure 8 – Scheme of gradation of academic degrees and engineering

Realization of intellectual scientometrics

This gradation reasonably classifies the principal requirements of scientific activity on the basis of the four intellectual (information – knowledge – understanding – research) stages of cognition in comparison with the one information stage (fig. 4-6), and adequately interprets the scientometrics as intellectual process.

The determining factor of universalization and intellectualization of scientometrics is the transition from information indicators of scientific cognition to cognizing concepts. The main objects of assessment of scientific and engineering content of publications and researches are the concepts as a measure of knowledge in general system of mankind knowledge. These ideas were repeatedly suggested in many research papers, for example in [16], but in this one they are fundamentally grounded.

Intellectual scientometrics should research the concepts of every scientific and engineering development: assign initial concepts, new concepts, extent of their novelty, derivative concepts and their novelty, significance and urgency of these concepts, general size of subsystem of derivative concepts, theoretical and practical value, potential of these concepts, mutual compatibility and inconsistency of concepts, origin of every concept, and many other aspects following from the universal theory. It is easy to realize by reformation of the section «key words» to «key concepts» in accordance with the specially agreed pattern of properties of applicable concepts, depending on the statements of the author of publication, which are verified by the reviewers and readers, after what the publication obtains not only the rating, but a specific place in continuously developing science. Combination of such patterns forms a map of concepts, the research of which clarifies the general condition of current science and its certain areas [17]. Such map can be based on initial system of concepts of the universal model, considering the existing

scientific classifications. Further the map of concepts should be developed in two complementary ways. On the one hand we should implement a well-known successively progressing methodology of automatic intelligent reviewing and analysis of scientific texts to assign and include the general scientific subjective dogmatic system of concepts in the map [16], though this system adopts all unsolvable faults shown at the fig. 1. On the other hand we can formally deduce the absolute subsystems of concepts voiding these faults from the universal model, correct with their help corresponding subjective concepts, and successively absolutize their common system of concepts. Availability of such pair of systems of concepts for the first time allows proceeding to the purposeful absolutization of science.

Universal scientometrics, under condition of harmonization with all peculiarities of scientific activity in different areas, can actually order scientific activity on worldwide scale, associate branches of science, disclose the real value of every publication and the authors. Applied to modern publications, it reveals scientific inconsistency of some research papers. For example, the special theory of relativity of Albert Einstein, followed from the researches of H. Poincaré and H. Lorentz, is typical overestimated PhD. On the other hand, the special theory of relativity is underestimated as an attempt of the first scientific universalization, made in physics, which can be generalized for all fields of knowledge, but failed because it was rejected by scientific community.

Assessment of knowledge by concepts opens the door to pioneering researches both in science and engineering. The value of research papers will be estimated not by the number of pages in publications, but by their conceptual content. Every theoretical and applied development becomes more effective if it is based on new concepts of higher level. However, this approach has a disadvantage caused by ambiguity of traditional usage of the concept «science» as 1) new knowledge and 2) the whole stock of knowledge of the mankind, which is rich itself and requires keeping its urgency even without practical basis. The scientific community should decide on this dualism and their attitude to it.

Intellectual scientometrics in training

Intellectual scientometrics in its second meaning is rather applicable to cognition through the training (fig. 9), applied according to the map of concepts following the cognition through the research (fig. 4). The training is implemented by intermediate subject (teacher), knowing necessary system of concepts [13].

Universalization of training allows us to manage compatibility, logical order and possible volume of digestion of concepts for improving the quality of education of every individual and collective person [18], [19].

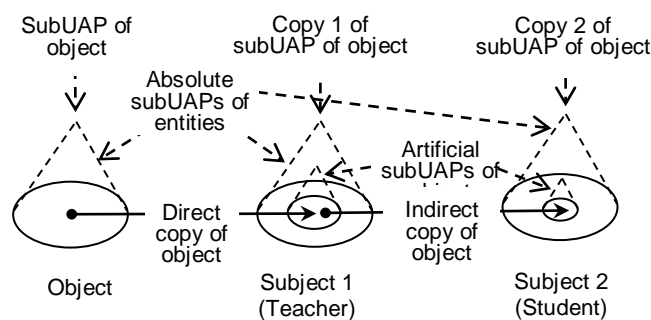


Figure 9 – Scheme of cognition through training

Conclusion

Intellectualization of scientometrics makes it possible to measure knowledge and to manage the process of its acquiring, disseminating and employing and can be already used by means of conversion from information indicators to the system of concepts in science, engineering and education.

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RESUME*Sosnitsky A. V.**Intellectual Scientometrics*

Background: Modern scientometrics presents the science as the information process measured by information and statistic indicators of published scientific information. This essentially contradicts the intellectual properties of science and any kind of cognition such as knowledge, mind, intelligence, thought, cognition, evidence, study, learning, etc. The reason of this divergence is the lack of single scientific theory of intelligence in the modern science, that does not allow us to adequately ground and apply the intellectual indicators of cognition.

Materials and methods: The purpose of this paper is the universalization of the concept of scientometrics through the universal theory, which allows us for the first time to formalize the system of intellectual concepts and initial definition of intelligence. This substantiates the intellectual indicators of scientific process and studies the ways of their application in modern science.

Results: The paper shows that the determining factor of universalization and intellectualization of scientometrics is the transition from information indicators of scientific cognition to cognizing concepts. The main objects of assessment of scientific and engineering content of publications and researches are such concepts as a measure of knowledge in general system of mankind knowledge. The paper proposes to create the single map of the universe concepts through special conceptual patterns of scientific publications and automatic conceptual reviewing of scientific texts on the basis of the universal theory. It allows us to adequately assess the requirements of the Supreme Certifying Commission, to define the specific place in continuously developing science and to purposefully absolutize the knowledge in the publications.

Conclusion: Intellectualization of scientometrics makes it possible to measure knowledge and to manage the processes of its acquiring, disseminating and employing and can be already successively developed in science, engineering and education under condition of achieving general scientific agreement.

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